



*Climeworks DAC plant in Switzerland.*

## Oxford Study: DAC Just a Tiny Percentage of Current CDR Levels

By Mark Fogarty

“Novel” methods of carbon dioxide removal like direct air capture, biochar and bioenergy with carbon capture and storage (BECCS) currently account for just two-thousandths of a percent (0.002) of the two gigatons of CDR being removed annually from the atmosphere now, according to a new Oxford report which says it is quantifying worldwide CDR for the first time.

Almost all of CDR is currently coming through land management, and that needs to change, according to the authors of the report, who emphasize the need for more direct air capture.

This underperformance, which needs to be rapidly increased, is contributing to “a gap between how much CDR countries are planning to remove, and what is needed in scenarios to meet the Paris temperature goal,” according to the first “State of Carbon Dioxide Removal” assessment done by an international team of experts through the University of Oxford’s Smith School of Enterprise and the Environment.

“No matter which Intergovernmental Panel on Climate Change pathway humanity will follow, holding the global average temperature increase below 1.5°C will require removing increasing amounts of CO<sub>2</sub> from the atmosphere,” according to Artur Runge-Muller, former Director of the European Commission and its former

Directorate-General for Climate Action, in a preface to the Oxford report.

“Hard-to-abate greenhouse gas emissions will have to be balanced with removals in order to achieve net-zero CO<sub>2</sub> emissions in less than thirty years. From then onwards, vast amounts of CO<sub>2</sub> will have to be captured from the air for many decades, cleaning up the atmosphere and returning atmospheric CO<sub>2</sub> to climate-safe levels,” according to Runge-Muller.

The CDR gap “calls for urgent action on all CDR fronts,” writes Runge-Muller. Convenors of the wide-ranging study include Stephen M. Smith (University of Oxford); Oliver Geden (German Institute for International and Security Affairs); Jan C. Minx (Mercator Research Institute on Global Commons and Climate Change); and Gregory F. Nemet (University of Wisconsin-Madison). More than a dozen authors took part in putting together the various chapters.

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According to the report’s executive summary, “The size of the ‘CDR gap’ differs across scenarios, depending on how we choose to transform the global economy towards net-zero emissions. However, there are currently few plans by countries to scale CDR above current levels, exposing a substantial shortfall.”

Almost all of the two gigatons of yearly CDR the report has quantified “comes from ‘conventional’ CDR on land, primarily via afforestation, reforestation and management of existing forests,” the authors write.

Closing the CDR gap “requires rapid growth of novel CDR,” the authors maintain.

“Averaging across scenarios, novel CDR increases by a factor of 30 by 2030 and by a factor of 1,300 by mid-century. Yet no country so far has pledged to scale novel CDR by 2030 as part of their Nationally Determined Contribution, and few countries have so far published proposals for upscaling novel CDR by 2050.”

CDR is not a silver bullet, the authors say.

“Scenarios that limit warming to 2°C or lower require deep cuts to emissions in addition to, not in place of, CDR. A few scenarios do meet the Paris temperature goal without novel CDR, but these require even more aggressive emission reductions, which we are not on track to achieve. To help manage uncertainties and risks associated with CDR at large scales, our dependence on it should be limited by reducing emissions faster.”

The need for CDR may be underestimated by nations that have enthusiastically embraced reducing emissions, the Oxford report says.

“Over 120 national governments have a net-zero emissions target, which implies using CDR to counterbalance residual emissions, but only a few explicitly integrate CDR into their climate policies. The next decade is crucial for “novel” CDR, in particular, since the amount of CDR deployment required in the second half of the century will only be feasible if we see substantial new deployment in the next ten years, novel CDR’s formative phase. Yet our assessment reveals few countries have actionable national plans to develop CDR, particularly for novel methods.”

That being said, there has been a lot of interest in CDR in the past few years, say the authors.

“The peer-reviewed scientific literature on CDR is growing faster than for climate change as a whole, now consisting of over 28,000 English-language studies. Most focus on land-based biological CDR methods such as biochar and soil carbon sequestration. Almost all are published in science and technology journals, with very few in social sciences or humanities publications, and only about a third have a specific geographic focus. This indicates a potential lack of information tailored to specific local contexts, particularly for novel CDR methods.”

The authors also have some kind words for innovation in CDR.

Innovation “has expanded substantially in recent years. We see evidence of this in over \$4 billion of publicly funded Research, Development and Demonstration (RD&D), a rise in patents (with China the lead country and Direct Air Capture the most patented technology) and investment in new CDR capacity totaling approximately \$200 million from 2020 to 2022. CDR is becoming more of a public talking point too, although awareness remains low relative to other aspects of climate change.

They continue, “A growing number of scientific studies on how people perceive CDR indicate public support for research into CDR but raise concerns about deployment at scale. CDR methods that are familiar and often perceived as natural, such as afforestation, are viewed more favorably than others.”

Social media is playing a part, as well, they wrote. “Discussion of CDR on Twitter is growing fast, with a trend towards more positive sentiment for all CDR methods except BECCS. The primary policy implications of this first assessment of the state of CDR are that meeting Paris temperature goals requires us to accelerate emission reductions, increase conventional CDR and rapidly scale up novel CDR. Actionable policy proposals, with standardized transparent reporting and involving societal deliberation, will support and shape these outcomes in a manner that acknowledges both the urgency of the challenge and issues such as policy costs, hazards and land-use conflicts.”

